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Local epitaxy from the silicon substrate in silicon–rich SiC during Si–nanocrystals formation

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Abstract

This paper reports on the structural evolution of the silicon–rich SiC / c–Si interface upon 1100°C, 30 min thermal treatment, which is typically used when fabricating c–Si based devices that incorporate Si–nanocrystals in an SiC matrix. The onset of local interfacial epitaxy is revealed and analyzed. The inhibitory effect of a thin SiC interfacial buffer layer is reported. The investigation is based on Transmission Electron Microscopy and UV–Visible Reflectance spectroscopy. We show that a minimum thickness is required for the SiC buffer layer to preserve the presence and quality of the interface. The investigation also indicates that the epitaxial regrowth occurs in competition with random nucleation, which turns out to be the dominant crystallization mechanism in silicon rich SiC. A value 3÷10 nm is given for the diffusion distance of carbon in silicon upon 1100°C, 30 min thermal treatment, which confirms previously reported results. The investigation shows that qualitative as well as quantitative structural information can be rapidly and routinely obtained by careful analysis of UV–Visible Reflectance spectral data.